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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2022/2023 (TERM ID 2215)

BDS4614 – MANAGEMENT DECISION SCIENCE

(All sections/Groups)

22 FEBRUARY 2023
9.00 a.m – 12.00 p.m
(3 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 6 pages excluding the cover page, with 5 questions only.
2. Attempt **ALL** the questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Students are allowed to use scientific calculators (without restriction).
4. All necessary workings must be shown and please write all your answers in the answer booklet provided.

QUESTION 1

Boise Lumber has decided to enter the lucrative prefabricated housing business. Initially it plans to offer three models: standard, deluxe and luxury. Each house is prefabricated and partially assembled in the factory, and the final assembly is completed on site. The ringgit amount of building material required, the amount of labor required in the factory for prefabrication and partial assembly, the amount of on-site labor required, and the profit per unit are as follows:

	<i>Standard Model</i>	<i>Deluxe Model</i>	<i>Luxury Model</i>
<i>Material</i>	RM 6,000	RM 8,000	RM 10,000
<i>Factory Labor (hr)</i>	240	220	200
<i>On-site Labor (hr)</i>	180	210	300
<i>Profit</i>	RM 3,400	RM 4,000	RM 5,000

For the first year's production, a sum of RM 8,200,000 is budgeted for the building material; the number of labor-hours available for work in the factory (for prefabrication and partial assembly) does not exceed 218,000 hrs; and the amount of labor for on-site work is to be less than or equal to 237,000 labor-hours.

- Formulate the given problem as a Linear Programming Problem. (4 marks)
- Set up the initial simplex tableau by including the necessary slack variables. (2 marks)

Given the following final tableau

C_j		3400	4000	5000	0	0	0	
	Solution Mix	X_1	X_2	X_3	S_1	S_2	S_3	Quantity
4000	X_2	0	1	0	0.001	0	-0.033	300
3400	X_1	1	0	0	-0.0007	0.0083	0.0167	300
5000	X_3	0	0	1	-0.0003	-0.005	0.0167	400
	Z_j	3400	4000	5000	0.23	3.33	6.67	4,220,000
	$C_j - Z_j$	0	0	0	-0.23	-3.33	-6.67	

S_1 – slack for Material available

S_2 – slack for Factory Labor hours available

S_3 – slack for Onsite Labor hours available

- Determine how many houses of each type Bois should build to maximize its profit from this new venture and what is the maximum profit? (2 marks)
- What are the shadow prices of the three constraints and explain the meaning? (4 marks)

Continued ...

- e) Which of the constraints are binding and explain why? (2 marks)
- f) Determine the range of optimality for the profit contribution rate of Standard Model. (3 marks)
- g) Determine the range for the right hand side of the Material budget constraint without changing the dual price. (3 marks)
- (Total: 20 marks)

QUESTION 2

Jackson distributes a variety of food products that are sold through grocery store and supermarket. The management has decided to automate the warehouse operation by installing a computer-controlled order-picking system, along with a conveyor system for moving goods from storage to the warehouse shipping area. The director compiled a list of activities and the time estimates associated with the project.

Activity	Immediate Activity	Time (weeks)		
		Optimistic	Most Likely	Pessimistic
A	-	4	6	8
B	-	6	8	16
C	A,B	2	4	6
D	C	8	10	24
E	C	7	10	13
F	E	4	6	8
G	C	4	6	20
H	D, F, G	4	6	8
I	D,F	4	6	14
J	H	3	4	5
K	I, J	2	4	6

- a) Draw a network diagram to represent the project. (5 marks)
- b) Compute the expected time and the variance for each activity time. (4 marks)
- c) Determine the critical path. (4 marks)
- d) Obtain the expected completion time for the project. (2 marks)

Continued ...

- e) Calculate the variance in the expected completion time for the project.
(2 marks)
- f) What is the probability that the project can be completed within 40 weeks?
(3 marks)
- (Total: 20 marks)

QUESTION 3

- a) Itech is selling different types of electronic devices. It has four branches located in Perak, Pahang, Sabah, and Sarawak. Itech is currently selling a popular smartphone named as Future 10. Perak has a demand of 150 units of Future 10, Pahang needs 200 units, Sabah needs 80 units, and Sarawak needs 70 units. Itech can order Future 10 from suppliers located in Kuala Lumpur, Penang, Johor, and Selangor. Kuala Lumpur is able to supply 175 units, Penang has 150 units, Johor has 100 units, and Selangor has 75 units. The shipping costs per unit (RM) are shown in the following table:

<i>To From</i>	<i>Perak</i>	<i>Pahang</i>	<i>Sabah</i>	<i>Sarawak</i>
<i>Kuala Lumpur</i>	15	7	13	12
<i>Penang</i>	9	12	15	15
<i>Johor</i>	18	9	12	×
<i>Selangor</i>	8	8	16	13

× indicate that Johor is not able to supply any smartphone to Sarawak. Determine the optimal shipping plan and the minimum shipping cost.

(10 marks)

- b) Dr. Tan is assigning lecturers to subjects for the next trimester. The past three years failure rate is the main criterion for deciding who should teach each subject. The failure rates of each subject taught by each lecturer are shown in the following table:

<i>Subject</i>	<i>Lecturer</i>			
	<i>Dr. Lim</i>	<i>Dr. Chong</i>	<i>Dr. Cindy</i>	<i>Dr. Jenny</i>
<i>Statistics I</i>	15	12	15	16
<i>Statistics II</i>	12	11	14	13
<i>Research Methodology</i>	14	10	13	17
<i>Business Mathematics</i>	11	13	12	15

Determine all the optimal assignment of lecturers to subjects to minimise the overall failure rate. What is the overall failure rate?

(10 marks)

(Total: 20 marks)

Continued ...

QUESTION 4

Somerset Corporation purchases a particular brand of microchip used in the assembly of computers directly from the supplier. It costs the company RM 8 each time it places an order with the manufacturer for the microchips. The supplier will deliver order of any size for a charge of RM 4 and cost of holding an item in inventory for a year is estimated to be 20% of the cost price. Samuel, the store manager estimates that total annual demand for the microchip will be 600 units, with a constant demand rate throughout the year. Currently, the store is making 250 orders, two times in a month. Goods are received 10 days after an order has been placed. The store is open for business 300 days in a year.

- a) Calculate the total inventory cost based on the current ordering policy. (4 marks)
- b) Compute the optimum order quantity. (5 marks)
- c) Based on the optimum order quantity, determine the reorder point. (3 marks)
- d) If the supplier offers large order discounts of 8% and 10% for single order quantities of minimum 400 and 500 respectively, should the company change its ordering policy? (8 marks)

(Total: 20 marks)

QUESTION 5

A local real estate investor in Cyberjaya is considering three alternative investments: a motel, a restaurant or the theater. The following payoff table provides profits and loss based on various possible investment decisions and demand situations.

<i>Investment</i>	<i>Demand</i>		
	<i>High (RM)</i>	<i>Moderate (RM)</i>	<i>Low (RM)</i>
<i>Motel</i>	1500	700	- 500
<i>Restaurant</i>	1000	800	- 600
<i>Theater</i>	900	900	- 700

- a) What is the best decision based on maximax criterion? (4 marks)
- b) What is the best decision based on maximin criterion? (4 marks)

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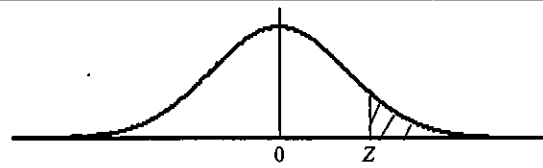
- c) Determine the best strategy using Equally Likely. (4 marks)
- d) Compute the criterion of realism decision and use $\alpha = 0.8$. (4 marks)
- e) What is the minimax regret decision? (4 marks)
- (Total: 20 marks)

End of Paper

APPENDIX:

Table 1

The Upper Tail Area Under the Standard Normal Curve



Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641
0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
3.5	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
3.6	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
3.7	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
3.8	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
3.9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4.0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000